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ABSTRACT

The Oregon Advanced Technology Consortium (OATC) created the Partnerships for Quality Project (PQP) to improve Oregon's community colleges by developing a total quality curriculum (TQC) based on the beliefs and practices of total quality management (TQM). This report summarizes the recommendations of the PQP and presents a plan of action for the state's community college presidents to develop and implement total quality practices. Following an overview of the project vision, mission, and approach, the second chapter identifies the customers of the TQC as employers, employees, and students, and describes the needs specific to each group. The third chapter identifies the guiding principles behind the recommendations, including ensuring a customer focused program, maintaining an integrated, holistic philosophy, implementing a flexible approach, and applying total quality practices to community colleges. Chapter 4 describes the core topics of the TQC, including the core philosophy and foundations, the tools and skills of TQM, teamwork, management considerations, and information concerning marketing, application engineering, manufacturing, engineering and quality function personnel. The final chapter presents recommendations designed to guide the OATC Board of Directors in developing and implementing a customer driven TQC based on the TQM philosophy. (MAB)

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Partnerships for Quality:
A Statewide Plan for Developing and Implementing a Total Quality Curriculum Delivered Through Oregon's Community Colleges

Oregon Advanced Technology Consortium
Oregon Economic Development Department
Oregon Quality Initiative

JC 940 141

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June 1993

The Partnerships for Quality Project is a joint effort of the Oregon Advanced Technology Consortium (OATC), the Oregon Economic Development Department, and the Oregon Quality Initiative. This document summarizes the recommendations of the Partnerships for Quality Taskforce, a group of private sector, public sector, and education representatives concerned and committed to total quality training and education for Oregonians. Project coordination services were provided by Workforce Strategies, a private consulting firm in Portland. This project is funded through a developmental grant from the Oregon Economic Development Workforce Development Program. This project was paid for with Oregon Lottery Funds.

The OATC is a consortium of twelve Oregon community colleges serving primarily small and mid-sized manufacturing businesses which are seeking access to advanced technology services and training. The mission of the OATC is to improve the competitiveness of Oregon industry through technical training and technology transfer.

Oregon Advanced Technology Consortium Members:
Blue Mountain Community College
Central Oregon Community College
Chemeketa Community College
Clackamas Community College
Clatsop Community College
Columbia Gorge Community College
Lane Community College
Linn-Benton Community College
Mt. Hood Community College
Portland Community College
Rogue Community College
Southwestern Community College

For additional information about the project or to receive additional copies of this report, contact:
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June 1993

About This Statewide Plan:

This plan, developed by the Partnerships for Quality Taskforce, presents a *spirited challenge* to Oregon's community college presidents and the Oregon Advanced Technology Consortium to implement total quality practices in our community colleges and to deliver a comprehensive total quality curriculum for Oregon employers, workers, and students. Total quality refers to a set of beliefs, tools, skills, and practices, including total quality management (TQM) and continuous improvement, that focus on quality and customer service.

Total quality education and training are critical to Oregon's gaining a competitive advantage in the global economy. This Plan voices the needs of the community college's primary customers: Oregon private and public employers. The recommendations in the plan call for nothing less than organizational transformation and a different way of doing business. We ask that you read this report and commit your institution to action, taking steps toward developing the best total quality community college curriculum in the country. Keep this report off your bookshelf. There's no time to gather dust.

—Partnerships for Quality Taskforce

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1 *Overview*

Project Vision, Mission, and Approach

The Oregon Advanced Technology Consortium (OATC), through its Quality Institute, is spearheading a multi-phase effort, The Partnerships for Quality Project, to build the capacity of Oregon's community colleges by developing a total quality curriculum and a cadre of skilled instructors to deliver the curriculum. Total quality refers to a set of beliefs, tools, skills, and practices, including total quality management (TQM) and continuous improvement, that focus on quality and customer service.

The project's vision is to improve the productivity and competitiveness of Oregon's businesses and institutions and contribute to achieving Oregon's "best workforce in the world" benchmark. The mission of Partnerships for Quality is to develop and implement:

- A state-of-the-art curriculum and cadre of skilled instructors that are responsive to the needs of Oregon's employers, workers, and students.
- A well-designed and tested curriculum and delivery system.
- A continuous improvement mechanism for the curriculum, instructors, and delivery system which measures effectiveness and benchmarks against world class standards for community colleges.

The result of the first phase of the Partnerships for Quality Project is this document, *A Statewide Plan*, which outlines the customer requirements, guiding principles, and core topics for the curriculum. The focus of this first phase, which began in mid-February 1993, was to "listen to the customer" and to chart a "roadmap" for the project's subsequent phases: developing the curriculum, training instructors, and implementation.

Several of Oregon's community colleges currently offer a number of total quality courses from Introduction to Total Quality Management and Teambuilding to Statistical Process Control. The aim of the Partnerships for Quality Project is to build the community colleges' capacity by enhancing these efforts through a systematic and comprehensive approach to curriculum development based on customer needs.

The development of the Plan was a collaborative effort of the Partnerships for Quality Taskforce, which was composed of 15 representatives of Oregon's customers and service providers. The taskforce gathered and analyzed baseline data; developed the guiding principles, core curriculum topics, and customer requirements; and formulated the strategies and recommendations for development and implementation of the project.

Eight private sector members of the taskforce represented: Oregon Quality Initiative (OQI), American Electronics Association (AEA), American Society for Quality Control (ASQC), Association for Quality and Participation (AQP), and the Society for Manufacturing Engineers (SME). Seven public sector members represented the Oregon Advanced Technology Consortium's Quality Institute, the public sector agency coordinators, higher education, Chemeketa Community College, Oregon Economic Development Department, and the Oregon Advanced Technology Center. Four of the taskforce members served as the management team for the project. Each taskforce member involved its members and constituents in gathering baseline data and informed them about the project.

The Partnerships for Quality Taskforce met for three half-day sessions in April and May as well as in several subteam meetings. This phase of the project was staffed by a part-time coordinator and a meeting facilitator.

Oregon's Economic Competitiveness Strategy

Oregon has established itself as a national leader in progressive economic development efforts. In 1988, Oregon initiated a strategic economic planning process involving hundreds of citizens from the public and private sectors. The result, *Oregon Shines*, concluded that investing to build a superior workforce was one of the keys to an advanced economy providing high paying jobs. *Oregon Benchmarks*, a set of indicators of Oregon's growth and development, resulted from this effort in order to keep Oregon focused on measurable outcomes and the state's economic future.

By 1989, the state had begun to work to implement an economic competitiveness strategy on three fronts: workforce development, key industries development, and assisting firms in implementing quality improvement practices and programs. Well-trained and educated workers are crucial to the overall health of Oregon businesses and their ability to compete locally and globally.

Workforce Development. Oregon is focused on raising educational standards to the highest in the world and producing the most highly skilled workers in America by the year 2000. To accomplish these goals, a comprehensive school reform agenda was adopted by the Legislature in 1991. The reforms focus on producing secondary school graduates who meet internationally competitive education standards and who have acquired significant practical work skills.

Also in 1991, the Oregon Workforce Quality Council, composed of business, labor, and community leaders as well as state agency department heads, was created to develop a comprehensive strategy for improving the quality of Oregon's workforce. Fifteen Regional Workforce Quality Committees comprise the local community-based arms of the statewide council.

In 1989, five (and subsequently twelve) of Oregon's community colleges formed the Oregon Advanced Technology Consortium (OATC) to provide technical training and technology transfer to develop skills of Oregon workers. In 1991 the OATC developed a Quality Institute for the purpose of building Oregon's pool of

trained Quality professionals and certified Quality trainers. The Institute also maintains a list of trainers and their availability as a resource for Oregon's business. In 1993 all consortium member colleges participated in this capacity-building effort, the Partnerships for Quality Project which will continue through 1993-94.

The Oregon Economic Development Department's (OEDD) Workforce Development efforts organize business, industry, and education partnerships for the purpose of quality job creation. These efforts align with the OEDD's mission to maintain and promote the vitality of Oregon business and assist in the creation of family-wage jobs for Oregonians.

Key Industries Development. Another part of Oregon's economic competitiveness strategy involves targeting for concentrated development key industries in the state that provide economic diversity, stability, and family-wage jobs and which are environmentally sound, have growth potential, and possess a comparative economic advantage in Oregon. Thirteen key industries have been identified. Associations for each of these key industries have been established and are engaged in determining the investment, educational, financial, and regulatory needs of their industry and finding ways to respond to those needs.

Assisting Firms in Implementing Quality Improvement Practices. The Partnerships for Quality Taskforce is an important part of the state's economic strategy. It is focused on both workforce development and assisting firms to implement quality improvement practices through a customer-driven total quality curriculum. The project works closely with and will continue to work closely with the Oregon Quality Initiative and other related workforce and quality-related initiatives in the state.

The Oregon Quality Initiative (OQI), spearheaded in 1992 by the Oregon Economic Development Department, has spun off as a private, non-profit corporation. The organization's mission is to help Oregon firms and organizations move quickly and confidently toward achieving world class standards for quality and customer service. The OQI is currently developing programs that will be available to businesses and public organizations later this year.

Report Organization

This report represents the first phase of the four-phase project to develop a total quality curriculum to be delivered through Oregon's community colleges. It is intended to serve as the roadmap for the project and is organized into the following chapters.

Chapter 2 discusses the identified *customers and their requirements* as well as the context for customer needs.

Chapter 3 outlines the *principles* that guide the thinking, approach, and recommendations made by the taskforce.

Chapter 4 itemizes each of the recommended *core topics for the curriculum*. A description of each topic is included.

Chapter 5 summarizes the *taskforce recommendations* for transition activities prior to the beginning of the project's next phase, as well as recommendations for future phases, including delivery and implementation.

The Appendices contains a recommended list of total quality resources and a list of total quality practices and beliefs.

This report does *not* address how to motivate management and business owners about total quality, prescribe detailed operating plans for implementation, or focus on higher education or post-graduate requirements for total quality.

2 *Customer Requirements*

The taskforce identified three groups of customers of an effective total quality curriculum: employers, employees, and students. The taskforce views Oregon private and public employers, from both manufacturing and service organizations, and especially small employers, as the primary customer for the total quality curriculum. Expectations or requirements of each of the customer groups are as follows:

Employers

Requirements: A continuously improving and productive workforce, return on investment, high level of personal investment and commitment of workers, decreased turnover, increased skills of applicants and workers, increased cross training, ongoing process improvement, measurable results, teams that deliver results.

Employees

Requirements: Learning to be a learner, broader and better skills, continued employability and marketability, empowerment, advancement/promotion/ reward, recognition, increased job satisfaction, ability to keep up with state-of-the art management practices, confidence to make changes, ability to present ideas and information to groups, usable knowledge, flexibility.

Students

Requirements: College credit, recognition of worth in the job market, real world experience, opportunity for contact with the business community, relevance/ practical application of education, affordable cost, access.

In identifying these customers, the taskforce acknowledges that there are additional customers for the product, such as citizens, the legislature, and other stakeholders, but considers them to be secondary customers in the context of this project. Furthermore, the group acknowledges that community colleges may have to further prioritize and analyze this customer requirements summary, based on the constituents, needs, and resources of the individual community colleges.

Meeting the requirements of internal customers (community college administrators, faculty, and staff) is key to the success of the project. Project implementation calls for training to be provided to internal customers first and foremost so they can deliver quality instruction to employers, employees, and students.

In light of formulating customer requirements, the taskforce also emphasized the needs of the ultimate end product of the total quality curriculum: *the trained, productive worker*. To serve the needs of workers and students community colleges need to provide the following:

- A total quality curriculum
- Training
- A flexible delivery system
- Certification/college credit
- Geographic accessibility
- A quality orientation to service delivery
- A commitment to continuous learning.

In formulating the customer requirements, the taskforce emphasized the importance of a "ladder" or "building block" approach to developing worker and student skills and capabilities through a comprehensive total quality curriculum:

- Awareness
- Preparation
- Specialization
- Application.

In the *awareness* phase an individual or organization receives a "wake up call" internalizing the recognition that total quality is critical to both competitive survival and personal excellence. In the *preparation* phase, the individual masters a core set of basic skills and tools at a relatively generic level. In the *specialization* phase, the individual learns how the basic tools apply to the needs and circumstances of a specific function, such as manufacturing or human resources. In addition, more advanced tools, skills, and methodologies are mastered, along with the knowledge that enables appropriate application to occur.

Finally, in the *application* phase, both basic and advanced tools and methodologies are used to solve on-the-job problems. This is when the real quality improvement and its associated return on investment occur. In the majority of cases, quality improvement is executed by teams; therefore, the success of this phase is greatly enhanced if all prior learning, particularly in the specialization phase, occurs in the team mode.

3 *Guiding Principles*

The taskforce identified the following guiding principles for the project. The core curriculum topics, customer requirements, and recommendations included in this plan are based on these principles.

- Community colleges must identify their customer and strive at all times to be **customer-focused.** Their development and delivery efforts must be tailored to customer requirements. NOTE: In addition to the customer requirements described in the previous section, in-depth probing to uncover the unique requirements of each customer group will be necessary. Resolving conflicting customer requirements may force community colleges to prioritize among the needs of their different customer groups.

- Total quality is an **integrated, holistic philosophy.** Tools and techniques are important, but they are merely a means to achieving a fundamental objective—total customer satisfaction.

- Achieving quality requires a **cultural transformation.** The philosophy and concepts of total quality are common, but they must be adapted to each organization's unique culture. There is no single recipe, guaranteed formula or "cookie cutter" approach. Each community college will need to implement total quality and deliver the total quality curriculum in a way that supports its particular culture and the culture of those organizations it is serving.

- Quality improvement is a **never-ending journey,** not a management fad. Community colleges must take the first steps to implementing total quality in their organizations, knowing it will not be perfect the first time, but rather the first steps in transforming its organizational culture.

- In any total quality curriculum, specific content of quality tools and techniques is less important than the development of **supporting skills, capabilities, and attitudes:**

  - Collaborative (team-based) learning, so that students develop the ability to perform in cross-functional workteams
  - Systems thinking
  - Effective communication and leadership skills
  - General belief in continuous improvement.

- Total quality education delivered by community colleges should be **tailored to the needs of identified customers.** Training should be provided when needed— on demand, on-site. In addition to the customized training currently provided by community colleges, a market opportunity exists for a consulting capability or service. This would require development of a cadre of **organizational consultants** who are capable of:

  - Diagnosing a business' current quality level
  - Assessing its quality improvement development needs
  - Determining total quality training and implementation plans
  - Conducting follow-up assessment as implementation unfolds.

  This service could operate on at least two levels: broadly, looking at the entire organization's needs, or focused at the level of a specific problem that demands more immediate solution. In the latter mode, the community colleges would provide a "SWAT team" for quality improvement. This service is described further in the recommendations in Section 5 of this report.

- In order for faculty to teach subject matter convincingly, total quality practices must be **applied to community college processes.**

  - *First step:* Adoption of total quality principles by community college presidents.

  - *Second step:* Implementation of total quality piloted first in the departments that will be delivering the training to industry.

  - *Third step:* Application to administrative processes, at both departmental and organization-wide levels. Further information about this requirement is provided in Section 5 of this report.

4 *Core Curriculum Topics*

The taskforce recommends that the following core topics serve as the foundation for the total quality curriculum. A short description of each topic is provided. Each topic has been rated as either as either " 1 "—essential or " 2 "—beneficial or "nice to have." These core topics are not "cast in stone," but rather they are expected to be enhanced and refined in the curriculum development phase of the project. The core topics are grouped by the following categories and numbered sequentially:

- For the Entire Organization: Core Philosophy
- For the Entire Organization: Tools and Skills
- For the Entire Organization: Teamwork
- For Management
- For Marketing and Application Engineering Personnel
- For Manufacturing, Engineering, and Quality Function Personnel

For the Entire Organization: Core Philosophy

Essential Topics (rated 1):

1. Foundations of Total Quality

- Why undertake total quality? Why is it critical? What is it?
- Impact of global competition; high quality as a necessity for competitive survival
- Importance of clarifying the organization's vision, mission, values and goals, and aligning them with total quality principles (for example, strategic quality planning)
- Adoption of total quality requires large-scale organizational changes; shift in behavior at all levels
- Fundamental objective: total customer satisfaction
- Management by fact and data (not intuition)
- Importance of empowered work teams for accomplishing quality improvement goals
- Necessity for compensation and recognition and reward systems to support teamwork and quality improvement
- Historical overview of quality advocates/pioneers (Deming, Juran, others)

2. Customer Focus

- Importance of listening to the voice of the customer
- Necessity to have institutionalized mechanisms for translating internal and external customer needs and wants into product and service requirements

- Customer requirements as the sole determinant of what constitutes value-added activity
- Integrating customers into critical development and measurement activities (making the customer a "member of the team")
- Methods for identifying internal and external customers and for identifying and prioritizing their requirements

3. **Quality through Process Improvement**

- Old paradigm: inspect at end of process, so that no defects reach customer
- New paradigm: design in quality, so that defects are never produced in the first place
- Supporting concepts:
  - No test/inspection 100% effective in catching defects
  - Test/inspection costly, as are associated rework and scrap
- Effective product improvement must of necessity be predicated on process improvement

4. **Continuous Improvement**

- Focus on quality in all daily work activities
- PDCA (Plan-Do-Check-Act) at heart of all continuous improvement methodologies
- A key focus of continuous improvement is job simplification, which is predicated on assessing the value-added content of all work activities

5. **Quality for Service Organizations**

- Define attributes of personnel in a first-rate customer service organization
- Suggested list: communication, customer sensitivity, decisiveness, energy, flexibility, followup, impact/first impression, initiative, integrity, job knowledge, judgment, motivation to serve customers, persuasiveness/sales ability, planning, resilience, situation analysis, work standards
- Measurements for service organizations
- Identification, assessment, and improvement of critical work processes

Beneficial/Nice to Have (rated 2):

6. **Organizing for Quality /How to Implement Quality**

- Key elements of total quality organization: quality council, recognition and reward systems, support for education and training, etc.
- Methodology for identifying customers and determining their needs, developing product and service features that respond to those needs, and developing processes capable of producing those features
- Determining how operating plans will be transferred to each level in company (upper management, middle management, supervisors, and individual contributors)
- Importance of and methods for getting top management buy-in
- How to overcome roadblocks and obstacles

7. **Systems Thinking**

- Focus on organizations as systems
- Systems diagramming for interrelationships
- Five disciplines (personal mastery, mental models, shared vision, team learning, systems thinking) needed to create a learning organization

For the Entire Organization: Tools and Skills

Essential (rated 1):

8. **Tools of Quality / Basic Problem Solving**

- Seven basic tools of quality: cause and effect diagram, checksheet, control chart, flow diagram, histogram, Pareto analysis, scatter plot
- Plan-Do-Check-Act cycle and associated problem-solving models

9. **Process Mapping**

- How to develop process flow diagrams
- How to develop cross-functional process maps
- Analysis of "as is" process maps for disconnects and non-value added activity
- Creation of "should be" process map
- Action planning to migrate from "as is" to "should be" maps

10. **Measurement Systems / Metrics**

- Critical measures for total quality: defects, total cycle time, overall customer satisfaction
- How to collect and analyze such data
- Importance of ensuring that data is actionable, including feedback mechanisms
- Scope and management of quality performance data
- Sources of external performance data
- Formats and structures for reporting data, to increase its usefulness
- Examination of companies with benchmark measurement systems (e.g., Motorola, Federal Express)

11. **Benchmarking**

- How to identify appropriate benchmark targets
- How to conduct a benchmarking study, focusing on both performance standards and best-in-class practices
- How to collect and analyze competitive benchmark data with emphasis on setting reachout improvement goals

12. **ISO 9000 Certification**

- Levels of ISO certification/registration
- Benefits derived from achieving compliance
- Costs of nonconformance
- How to assemble team of internal auditors
- How to choose an external certification agency
- How to plan for and schedule activities required for certification
- How to develop documentation requirement to successfully achieve ISO 9001 (or 9002) certification

Beneficial/Nice to Have (rated 2 or 2.5):

13. **The Cost of Poor Quality**

- Components and methods for collecting and calculating costs associated with scrap, rework, excess inventory, non-optimal cycle times
- Making commitment to the philosophy of eliminating wasteful activity

14. **Hoshin Planning and Policy Deployment**

- Priority and goal setting: basic techniques with emphasis on making goals measurable and aligned with strategic quality objectives of the organization

- Practice in use of the seven planning tools: affinity diagram, interrelationship diagraph, tree diagram, matrix diagram, prioritization diagram, prioritization matrices, process decision program chart, activity network diagram

For the Entire Organization: Teamwork

Essential (rated 1):

15. Teambuilding for Quality Improvement Teams

- Stages of team development: forming, storming, norming, performing
- Different types of teams: short-term improvement teams, process management teams, high performance work teams, cross-functional teams, etc.
- Role of upper management is providing resources and coaching for teams
- Importance of clearly established team groundrules and roles: team leader, facilitator, management mentor/executive sponsor
- Analysis of individual personality styles and how they contribute to team dynamics
- Importance of tolerating and accommodating diversity

16. Team Facilitator Training

- Consultative, analytical, and instructional skills
- Emphasis on influence management and removing barriers to team success
- Extensive practice in use of basic quality improvement tools
- How to conduct effective meetings
- Role of facilitator as coach to both team and team leader

17. Basic Communication and Interpersonal Skills

- Active listening
- Giving and receiving both positive and negative feedback
- Dealing with difficult people
- How personal styles influence group dynamics
- Awareness of personal communication and learning styles

18. Conflict Resolution and Management

- Various approaches to conflict: avoidance, control/dominance, accommodation, compromise, collaboration
- Principled negotiation for managing conflict: people, interests, options, criteria

- Learning process for improving conflict management skills: become awareness, analyze situation, build skills, practice
- Pragmatic four-step process for resolving conflicts:
  1) List issues of the two parties (be objective, eliminate emotional content)
  2) Determine issues outside the appropriate realm of consideration
  3) Of remaining issues, identify areas of agreement or near agreement; negotiate compromise
  4) For issues still remaining, attempt compromise or impose solution

Beneficial/Nice to Have (rated 2)

19. Self-Directed Work Teams

- Defining seven levels of empowerment:
  Level 1 - Total Supervisor Responsibility – individuals do work assigned ... inefficiencies abound
  Level 3 - Supervisor consults team, members take responsibility for quality and production
  Level 5 - Team organizes and schedules work, prepares and presents plans and measurements ... process is maximized
  Level 7 - Team directs its owns customer relations, budgets, staffing ... people are maximized
- Importance of migration through all seven levels
- Education and training required to support migration
- Changing role of supervisors and managers
- Reward and compensation systems that support self-directed teams
- Experiences of companies that have successfully migrated to self-directed teams (Corning, Milliken, etc.)

For Management

Essential (rated 1):

20. Organizational culture change/transformation

- Understanding and managing organizational and systems change
- Strong emphasis that quality improvement requires cultural and organizational transformation
- Changing role of managers and workers; front-line workers as decision makers, managers as coaches, mentors
- Flattened organization, matrix management
- Human resource policies required to effect change to flattened organizational structure

21. Leadership

- Models for successful leadership (Covey, Kouzes & Posner, etc.)
- Essential leadership practices (challenging the process, inspiring a shared vision, enabling others to act, modeling the way, encouraging the heart)
- Characteristics of superior leaders
- Practice in creating challenging vision statements
- Changing role of leader as mentor and coach
- Stakeholder analysis and influence management, including successful techniques of lobbying and persuasion
- Leadership vs. management; necessity for both activities to exist simultaneously in organizations

22. Management's Role in Quality Improvement

- Focus on importance of top management leadership for success of total quality efforts
- Importance of integrating quality improvement goals into fabric of strategic and functional business plans
- Importance of considering both internal and external customers
- Goal setting and decomposing of high-level goals into specific improvement targets for products and processes
- Modeling behavior by both word and deed ("walking the talk")
- Personal accountability
- Establishing appropriate review and reporting processes
- Fostering empowerment and taking the lead in creating flattened organizational structures

23. Process Management/Improvement

- Specific role of management in process improvement
  - Identification of critical business issues and key processes
  - Establishing ownership for key processes (for cross-functional processes, may be at two levels: executive owner and working level, usually middle manager)
  - Establishing and reviewing key process measures
  - Supporting (providing resources for) process improvement teams and removing roadblocks
- Assessment/auditing procedures, for both internal and supplier processes

24. Understanding Variation for Managers

- Concept of statistical variation: probability of creating defective output measured against customer specifications
- Concept of "natural" or inherent variation in a process
- Techniques for distinguishing random from assignable-cause variation
- Taguchi loss function (importance of centering processes upon desired mean)
- Waste, rework, and excessive costs associated with excess variation
- Overview of statistical tools focused on identification, analysis, reduction/elimination, and control of variation

25. Customer Relations Management

- Importance of customer focus
- Identification of both internal and external customers
- Establishment of systems and procedures for actively soliciting as customer input and field performance data
- Escalation procedures for dealing with customer problems
- Mechanisms for tracking customer feedback and ensuring closed-loop, corrective action
- Specific techniques for defusing angry customers
- Pro-active involvement of customers in development of products and services

26. Employee Performance and Reward Systems

- Human resource management for employee involvement and empowerment
- Recognition and reward systems that support both quality improvement and team-based performance
- Merit-based pay
- Training and education required to support quality improvement and cross training
- Techniques for assessing employee satisfaction (well-being and morale)
- Job analysis, skills assessment, and subsequent gap analysis

For Marketing and Application Engineering Personnel

Essential (rated 1):

27. Soliciting and Defining Customer Requirements

- Market research techniques that facilitate in-depth probing of responses and ranking of preferences
- Constructing unbiased survey instruments
- Guidelines for eliciting narrative responses
- Appropriateness of specific information-gathering methods such as interview, focus groups, etc.
- Conjoint analysis
- Emphasis on importance of using customer's own language
- Verifying assumptions and validating responses from a small sample
- Emphasis on representative sampling and correction for non-respondents

28. Quality Function Deployment (QFD)

- Japanese-derived tool for building the "house of quality," which graphically depicts translation of customer requirements into product requirements, part requirements, and manufacturing and production requirements
- Demonstrates that customer needs are traced and realized throughout all phases of design, development, and manufacturing
- Facilitates ease of making product/service modifications that continue to fulfill customer requirements
- Importance of establishing dedicated, well-supported QFD teams if use of tool is going to be successful
- Experience of major companies that have successfully used QFD (Toyota, Hewlett-Packard, Ford, Procter & Gamble)

29. Design and Introduction of Quality Products and Services

- Principles contained in two programs above, with less emphasis on practice of specific techniques

For Manufacturing, Engineering, Quality Function Personnel

Essential (rated 1):

30. Statistical Process Control

- Demonstrating how tools for measuring and controlling variability in manufacturing processes work together
- Planning for data collection and constructing check sheets
- Designing and interpreting histograms
- Constructing Pareto charts, run charts, and scatter diagrams
- Developing and designing cause and effect (C&E) diagrams; mapping defect and cycle time data onto C&E diagrams
- Developing and analyzing process flow diagrams
- Developing and interpreting attribute control charts and variable control charts

31. Concurrent Engineering (Design for Manufacturability)

- Simultaneous product and process engineering that incorporates actual process capability data into development of critical design tolerances
- Use of Cp and Cpk measures to predict expected defect levels, in order to maximize defect-free, waste-free manufacturing
- Practices that support concurrent engineering
  - Maximal use of cross-functional development teams
  - Early supplier involvement
  - A well-defined development process
  - Formal and informal reviews
  - Standardized design/development methodologies
  - Defect budgeting
  - Common metrics (especially defects per unit)
  - Robust design using statistical tools
- Associated Design for Assembly principles and practices

32. Quality Auditing

- Techniques of auditing, independent of criteria used as basis of auditing (ISO, Baldrige)
- Methods for conducting an internal audit with in-depth simulation exercises focused on: interview preparation and developing a useful questions list, giving feedback, and writing recommendations for closed-loop, corrective action

33. **Supplier/Vendor Relations**

- Methods for ensuring on-time delivery of high-quality components and materials from vendors
- Emphasis on early supplier involvement in design and development activities
- Importance of building long-term relationships built on mutual trust
- Supplier audit systems that promote quality and cycle time improvement
- Contractual implications of early supplier involvement
- Overview of audit processes and standards required by critical customers (ISO, Baldrige, six sigma, etc.)

34. **Just-in-Time / Cycle Time**

- Overview of just-in-time manufacturing approach: push vs. pull systems, Kanbans and kitting techniques, etc.
- Change in traditional supplier relationships when JIT is adopted
- Concepts and techniques for reducing cycle time and increasing productivity
  - Importance of determining value-added activity and eliminating all non-value added steps and activities
  - Floor layout and material movement that enhance production flow
  - Total productive maintenance
  - Set up reduction techniques

35. **Understanding Variation**

- Concept of statistical variation: probability of creating defective output measured against customer specifications
- Historical approach (3 vs 4 vs 6 sigma standards)
- Use of Cp and Cpk measures to predict expected defect levels
- Concept of "natural" or inherent variation in a process
- Techniques for distinguishing random from assignable-cause variation, specific emphasis on one-way analysis of variance (ANOVA)
- Taguchi loss function (importance of centering processes upon desired mean)
- Waste, rework, and excessive costs associated with excess variation
- Overview of statistical tools focused on identification, analysis, reduction/elimination, and control of variation; specific practice with constructing and interpreting control charts

Beneficial/Nice to Have (rated 1.5 or 2):

36. Classical Design of Experiments (DOE)

- Defining nature of classical DOE: structured experiments in which factor levels are systematically and simultaneously altered, in order to determine quantified relationships between dependent and independent variables (or factors)
- Defining benefits of classical DOE (as compared to traditional "one-factor-at-a-time" testing)
  - Ability to detect interactions among factors
  - Experimental/test efficiency
  - Superior, more quantitative product/process knowledge
- Designing factorial experiments
- Techniques for the analysis of the results of full and fractional factorial experiments
- Techniques for successfully executing designed experiments, including:
  - Determining objectives of experiment
  - Assembling team to plan, conduct and analyze experiment
  - Writing proposal and final report

37. Taguchi Design of Experiments (DOE) Methods

- Experimental designs employing pre-determined patterns of orthogonal arrays with simplified analysis techniques (requires fewer tests than classical DOE; emphasizes main effects over interactions)

38. Designing Quality Software

- Emphasis on achieving quality in software
  - Defining the software development process
  - Determining, for each phase of process: key deliverables and supporting activities, key inputs phase entry and exit criteria, necessary functional involvements
  - Structured review processes
  - Assessment of organizational "maturity" (based on evaluation vehicle developed by the Software Engineering Institute)
  - Metrics for both software products and processes
- NOTE: Depending on demand/need, it may be necessary to offer separate programs for "real time" and database application.

5 *Recommendations*

The Partnerships for Quality Taskforce presents the following recommendations as a **spirited challenge** to Oregon's community college presidents and the Oregon Advanced Technology Consortium (OATC) Board of Directors in developing and implementing a customer-driven total quality curriculum.

Recommendation #1—Conduct Workshop with Community College Presidents and OATC Board

The results and recommendations of this statewide plan must be "rolled out" to the community college presidents and the OATC Board during the summer of 1993 in the form of a dynamic, **interactive workshop**. The purpose of this is to not only inform community college leadership about the results and recommendations, but also to provide an opportunity for these individuals to get hands on experience applying quality tools and practices. A workshop is critical to ensure that the elements of this plan are internalized by the community college presidents and the OATC board and that the workshop be designed and conducted so that this group begins to apply total quality principles to its own work.

Recommendation #2—Design Delivery Based on Customer Need

The total quality curriculum should be **delivered in a flexible format based on the customer's need**. Customer training needs are often met by on-site, short-term courses, workshops, or seminars. Delivery of the total quality curriculum needs to be tailored to each customer's organizational needs, rather than the traditional campus-based semester approach.

Recommendation #3—Prioritize and Analyze Customer Requirements

The taskforce acknowledges that community colleges may **need to further prioritize and analyze customer requirements** provided in Section 2 of the plan, based on the constituents, needs, and resources of each community college. It is vital to the success of this project that community colleges do not attempt to "be all things to all people."

Recommendation #4—Acknowledge the Unique Culture of Each Community College in Implementing Total Quality

The philosophy and concepts of total quality are common, but they must be adapted to each organization's unique culture. There is no single recipe, guaranteed formula or "cookie cutter" approach. Each community college will need to **implement total quality and deliver the total quality curriculum in ways that support its organizational culture.**

Recommendation #5—Provide Consulting Services for Employers

It is the belief of the taskforce that Oregon's small businesses can best be served by the community colleges providing **consulting capabilities** as described in Section 3 of this plan. This consulting service represents an enormous opportunity because it fills a critical customer need. Currently, small businesses generally cannot afford private consulting services, and they have few means to evaluate the experience and effectiveness of such vendors.

Recommendation #6—Pay Attention to the Needs of the Service Sector

In developing the total quality curriculum, particular attention should be given to providing emphasis, topics, and orientation for service industries and organizations, as well as the public sector. A specific course has been included in the core topics description **addressing the service sector,** but further ensuring that the curriculum provides a balanced orientation for both manufacturing and service industries is essential.

Recommendation #7—Infuse The Team Approach into Delivery and Implementation

Typically, the success of total quality implementation in an organization is based 15% on the technical skill set of employees and 85% on teamwork skill set and attitudes of employees (based on a recent study reported in the American Society for Quality Control publication, *Quality Progress*, April, 1993). Bill Ginnodo, Executive Director of the Quality and Productivity Management Association (QPMA) is quoted in the April 5, 1993 issue of *Industry Week* echoes this sentiment: "TQM is at least 80% concept and probably only 20% tools and techniques."

The taskforce recommends that a **teambuilding approach be infused in the development and implementation of the total quality curriculum.** For example:

- Tailor training to real applications of the customer
- Provide "textbook "examples as well as parameters for developing customized examples in courseware
- Encourage teams to go through training together
- Incorporate teamwork into curriculum delivery.

In addition, while developing curriculum, do not underestimate the amount of time needed for "hands on" exercises and activities as well as the importance of the role and multiple skill set of team facilitators.

Recommendation #8—Tailor Basic Skills as Needed and Conduct Basic Needs Assessment

Basic skills such as reading, writing, basic math, and statistics are not included in the total quality core curriculum, but mastery of them is a necessary pre-requisite for comprehension of all courses that are included in the core curriculum. It is important to recognize that basic skills courses may need to **be tailored to meet customers' total quality training needs**. Some type of screening **assessment** tool may be needed to ensure basic workplace skills of participants.

Recommendation #9—Develop College Credit Certification Process

The taskforce recommends that a **college credit certification process** for the total quality curriculum be established in subsequent phases of the project.

Recommendation #10—Establish a Steering Committee

The taskforce recommends that some form of **steering committee** be established to oversee both the implementation of the Partnerships for Quality Project's future phases and implementation of these taskforce recommendations. The exact scope and membership of this steering committee should be determined during the summer of 1993. The purpose of the steering committee will be to ensure the customer-driven development and implementation of the Partnerships for Quality Project and to "keep the volume turned up" on the need for highly skilled workers in Oregon.

Recommendation #11—Establish a Compact to Implement Total Quality

When a given community college expresses the desire to implement taskforce recommendations for total quality implementation, the taskforce suggests that its president sign a **"compact"** with the steering committee. Such a document would not, of course, be a legally binding agreement, but would document a commitment to transformation. The exact wording of any compact would depend on the resources and capabilities of the particular community college involved. Some suggested elements might include:

- A statement of the community college president's personal commitment to Total Quality principles; also evidence of the organization's intention to involve their customers by using such mechanisms as customer surveys, internal Baldrige-style self-assessments, etc.

- If the community college agrees to develop a cadre of organizational consultants, the "compact" would spell out a minimum performance standards for such consultants, as well as a feedback and evaluation mechanism for ensuring their adherence to the qualifying standards.

- The compact could include a set of criteria for qualifying total quality instructors as well as a plan for ongoing evaluation and improvement of courseware.

Recommendation #12—Establish Selection Criteria for Instructors

It cannot be too strongly emphasized that teachers of total quality must first be **practitioners** and disciples of total quality. In addition, they must have background and experience in "how to train." The steering committee should fashion and disseminate a **set of selection criteria for all total quality instructors.**

Recommendation #13—Publicize and Market Partnerships for Quality

In order for the recommendations and guiding principles of our Taskforce to achieve their greatest impact, they must be **creatively publicized and marketed** throughout Oregon. Some suggestions for a Partnerships for Quality marketing strategy include:

- Focused presentations by individual taskforce members to community colleges, local business gatherings, other appropriate audiences.

- Staging of a press conference that would stress the following: the public and private sector cooperation represented by the Taskforce; the employer-focused approach to improving the skills and knowledge of Oregon's workforce; making Oregon's economy more competitive in the global marketplace.

- Providing a press release and interview opportunities such as a press conference to ensure prominent coverage in *The Oregonian, Oregon Business Monthly,* and other media.

Recommendation #14—Continue Partnership with Other Quality Efforts

The Partnerships for Quality Project must remain that, a **partnership** among the private, public, and education sectors. In addition, throughout development and implementation phases the steering committee and project team and staff must continue to work closely with the Oregon Quality Initiative, as well as other workforce and quality-related initiatives throughout the state.

Recommended Resources

The following resources are recommended by taskforce members. Complete bibliographic information is not provided for each listing.

Books, Reports, Publications:

American Electronics Association. *Road Map to Total Quality Commitment.*

Association for Quality and Participation. *Voices from the Field: Uncovering the Dynamics at Work in the Quality and Participation Movement.* 1993.

Byham, William. *Zapp!: The Lightening of Empowerment.* Fawcett Columbine. 1988.

Deming, Edward. *Out of the Crisis.* Cambridge, MA: MIT Press.

De Mott, Joann. *Total Quality Control: Vocational Curriculum.* Corvallis, Oregon: Corvallis School District, 1989.

DuBrin, Andrew. *Contemporary Applied Management.* 3rd edition.

Ernst & Young. *International Quality Study: Best Practices Report. An Analysis of Management Practices that Impact Performance.* 1992. Available from ASQC.

Ernst & Young. *International Quality Study: The Definitive Study of the Best International Quality Management Practices: Top-Line Findings.*

Goal/QPC. *Memory Jogger: A Pocket Guide of Tools for Continuous Improvement.*

Imai. *Kaizen.* Random House.

Ishikawa. *Guide to Quality Control.*

Jobs for the Future. *Work Organization, High Skills, and Public Policy: Strategies for High Performance Work and Learning in Small Firms.* 1992.

Lohman, Tami. *High Performance Work Organization: Improving Oregon's Competitiveness in the Global Economy.* Salem, OR: Joint Legislative Committee on Trade and Economic Development, 1992.

Magaziner, Ira and Mark Patinkin. *The Silent War: Inside the Global Business Battle Shaping America's Future.* New York: Random House, 1989.

Malcolm Baldrige Quality Award. *1993 Award Criteria.*

Marshall, Ray, and Marc Tucker. *Thinking for a Living: Education and the Wealth of Nations.* New York: Basic Books, 1992.

Oregon Economic Development Department. *Oregon Works: Assessing the Worker Training and Work Organization Practices of Oregon Employers.* Salem, OR: Oregon Economic Development Department, 1993.

Osburn, Moran, Musselwhite, Zenger. *Self-Directed Work Teams: The New American Challenge.*

Osborne, David, and Ted Gaebler. *Reinventing Government: How the Entrepreneurial Spirit Is Transforming the Public Sector.* Addison-Wesley, 1992.

Pkuffer, John, and James L. Heskett. *Corporate Culture and Performance.* The Free Press. 1992. A survey of the relationships of corporate culture and performance in 200 U.S. companies.

Redburn, Ray *et al. Confessions of Empowering Organizations: Who's Doing it and How.* Association of Quality and Participation. 1992. Case studies from 80 Oregon companies.

Reich, Robert. *The Work of Nations: Preparing Ourselves for 21st Century Capitalism.* New York: Alfred Knopf, 1991.

Robertson, Jim. *Transforming the University: The Total Quality Challenge.*

Rummler, Geary A,. and Alan P. Brache. *Improving Performance: How to Manage the White Space on the Organization Chart.* Jossey-Bass, 1990.

Schotles, P. *Team Handbook.* (With supporting materials).

Sematech, Inc.. *Partnering for Total Quality: A Total Quality Guidebook.* 1990.

Thurow, Lester. *Head to Head: The Coming Economic Battle Among Japan, Europe, and America.* New York: William Morrow, 1992.

Wilson and Hanna. *Groups in Context.* 2nd edition.

Courses:
From Motorola: Design for Manufacturability, Understanding Six Sigma, Designing Quality Software, Managing for Continuous Improvement."

From Xerox: "Leadership Through Quality: (Process Improvement)."

Videorecordings:
Encyclopedia Brittanica. *TQC Series.*

Building High Performance Work Teams (with Ken Blanchard). Coronet.

The Sidearm Team Story. Motorola.

Total Quality Practices and Beliefs

The following list of total quality practices and beliefs was compiled by the taskforce members and reflects a pooling of their knowledge, experience, and "significant learnings." In addition, the experience of leading quality organizations has shown that these total quality practices and beliefs constitute a holistic system or approach to implementation. Partial implementation of the following practices and beliefs will dramatically decrease probability of the overall success of total quality implementation in an organization.

- A shared **vision** of quality excellence that inspires everyone in the organization. **Total customer satisfaction** is a fundamental component of vision.
- Active, involved **leadership** from top management, aligned in both words and deeds.
- Quality defined by the **customer**.
- Active listening to the **voice of the customer.** Institutionalized mechanisms for translating customer needs and wants into product and service **requirements.**
- Use of an organization-wide **quality council** to set policy and monitor overall progress.
- **Integration** of quality policy and goals into the organization's business plan.
- Use of a **measurement system** that encompasses all products, services and processes. Includes metrics for:
  - Defects (as defined by customers or recipients of output)
  - Total cycle time
  - Overall customer satisfaction.
- Use of **benchmarking** to determine best-in-class performance and practices.
- Aggressive **improvement goals** derived jointly from benchmarking and listening to the voice of the customer.
- **Management by fact** and data.
- **Documentation** of all critical processes.

- A methodology for **improving processes** that is simple, well understood, and practiced throughout the organization.
- Mechanisms and systems for **internal self-assessment**.
- An ingrained ethos of **continuous improvement**. No matter how good the current state is, it can always be improved.
- **People** are considered the most valuable asset in the organization. To achieve quality goals, involvement by **everyone** in the organization is required.
- **Empowered work teams** and **flattened organizational structures** replace hierarchies and reduce the sharp division between management and workers.
- **Recognition and reward systems** to promote quality improvement and team performance.
- **Extensive training and education** of workers on both the "why" of total quality as well as the "how to."